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1. **General Information:** Metallic flavors are normally created in beer from either direct contact with metal or from the brewing water. Iron is a common culprit from water. Both are found in the brew house, especially if they are on a budget. Low PH eats off nickel coatings leaving bare metal. It does not take much contact time for it to change the beer. Usually it is just enough to sacrifice the beer's greatness.

- **Iron:** Common in brewing water, either naturally or from old rusting pipes. Simple test strips are available from scientific supplies stores that will test for iron. It will blacken porcelain and spots fabrics at rates of .02 ppm. It causes white turbidity and increases corrosion of metals. At rates above 1 ppm it will weaken yeast, increase haze and increase oxidation of tannins. It is easily removed by aeration and followed up with filtration. According to George Fix, .075 ppm is required for yeast health. Usually malt will supply this requirement for all malt beers. Greg Noonan recommends a maximum level of .3 ppm. Other sources of iron are enamel brew pots that are chipped, nickel plated valves and counter pressure bottle fillers. Old dairy equipment even though it is stainless can contain enough iron to cause flavor problems in beer. Look for the 3A dairy grade.
- **Copper:** A required yeast nutrient and the reason why many breweries still have copper in their system. Remember that brew pots are still called coppers from the use of copper kettles. Too much is a bad thing as it causes yeast mutation and haze. It will cause blue green streaks on white porcelain. I have never been able to attribute the copper flavor or yeast mutation from chilling hot wort with a copper tube. According to George Fix, .012ppm is required for yeast health. Greg Noonan recommends levels less than 1 ppm. On successful fermentation, it is usually a problem from packaging equipment as the alcohol combined with low PH strips off more metal ions. Common problems are copper racking canes and counter pressure bottle fillers. When I changed the construction of mine CP filler to all SS I could taste the difference.

2. **Flavor and Aroma Profiles:**

- **Iron:** Commonly described as inky. Other descriptors include blood like, coins, and rusty. During my tasting for the class, I found at low levels it makes beers monolithic, removing the joy from them. Detectable at levels of .05ppm
- **Copper:** Increases the astringency of the beer. May taste like copper but usually astringency and harshness in character are the main attributes.

3. **How to doctor:** To flavor beer with metallic off flavors it is easier to do after fermentation. After fermentation the low PH helps to remove the metal ions into solution. For the class I did the same process for iron and copper. Open cap on a chilled beer. Put an iron or copper pipe into the beer for a set period of time. I did the class beers for 45 seconds. Also take the cap off the control beers so oxidation potential is similar for all beers.

Metallic 11/25/07 By Ted Hausotter

4. Suggested Reading:

New Brewing Lager Beer by Gregory Noonan
Principles of Brewing Science by George Fix
Zymurgy special troubleshooting issue 1987

5. Class Beers:

- American Pale Ale homebrewed
- Schwarzbier homebrewed

